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The role of knowledge codification

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INTERNAL VERSUS EXTERNAL LABOUR FLEXIBILITY: THE ROLE OF KNOWLEDGE CODIFICATION[*]

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Abstract

This article uses a competence-based approach to the firm in order to analyse the recent destabilisation of internal labour markets. We argue that increasing knowledge codification made possible by the diffusion of information and communication technologies has made competences less dependent upon individuals. Knowledge has been increasingly embodied in firms themselves which has played an important role in lowering the relative cost of human resource management strategies based on external labour flexibility. As a consequence, recourse to external labour markets has developed, which may harm firms' innovative capabilities in the long run.

Key words: competences, knowledge codification, information technologies, internal labour markets.

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INTRODUCTION

For almost 20 years now, labour markets in the industrialised countries have been undergoing profound changes. The most striking of these changes – or at least the one that has attracted most attention - is certainly the increase in the share of skilled workers in the total volume of employment and in wage bills and the corresponding deterioration in the employment and pay prospects of less skilled workers (Katz and Autor, 1999). Several factors have been suggested as explanations for these developments, among which technological and organisational changes (see Chennells and Van Reenen, 2002) and international trade, which all increase the demand for high-level skills in industrialised countries.

A second stylised fact, less closely examined but nevertheless very striking, concerns the destabilisation of internal labour markets following the adoption of management methods based on external labour flexibility. According to Doeringer and Piore (1971), internal labour markets are characterised by the existence of long-term relations between employers and employees, progression along a pre-defined career path, a limited number of "ports of entry" in the course of a career and the existence of a stable pay hierarchy, both between the various jobs and over time. For Marsden (1986), internal labour markets stand in contrast to so-called occupational labour markets. In the former, vacant positions are mainly filled by promotion or internal mobility, while in the latter, firms use the external labour market.

Traditionally, internal labour markets were particularly highly developed in France and the United States, whereas occupational markets predominated in Germany and the United Kingdom. Over the last two decades, however, human resource management has changed. In particular, internal labour markets have been profoundly destabilised, whereas the use of external flexibility, which used to be a characteristic of the occupational model, has increased to a hitherto unknown extent. In the United States, job *instability* increased for all categories of employees during the 1980s – see Neumark (2000). The 1990s saw a reduction to eight years in long retention rates for workers with high seniority, and an even greater reduction for highly skilled workers in supervisory or managerial positions – Neumark et al. (2000). Valletta (2000) also points to an increase in job *insecurity* as reflected in an increase in dismissal rates among employees with high seniority over the period running from 1976 to 1992. Using the Displaced Worker Survey between 1984 and 2002, Farber (2003) also finds an increase in involuntary job loss in the mid-1990s. Finally, rates of transition between employment and unemployment

increased for highly skilled workers with high seniority during the recession of 1990, which was not the case in the more severe recession of 1982.

In France, the trend has also been to call into question long careers within the same company (Berton, 2001). Although there exists some evidence of internal labour markets continuing to function in larger firms for R&D occupations (see Béret, 2001), on average, job insecurity seems to have increased in the recent past. On French data, Givord and Maurin (2004) find an upward trend in annual transition rates from employment to unemployment over the period 1982-2002. Using the same definition of job insecurity over a longer period of time (1975-1999), Behaghel (2003) finds that job insecurity increased strongly for older workers (aged more than 55), and for workers with less than 5 years of tenure. This result is consistent with Gautié (2004), who underlines that internal markets have shrunk to include only workers in the intermediate age groups. According to him, young people and older workers have been gradually excluded from this so-called 'primary' segment of the labour market and are now largely located in a secondary segment in which external flexibility is the rule. Beffa et al. (1999) summarise this development by stressing that internal labour markets are seeing their scope reduced, in favour of occupational markets in the case of more skilled workers and in favour of a 'market flexibility' regime characterised by intensive use of mobility or even precariousness for less skilled workers.

In what follows, we propose a theory of the decline in internal labour markets based upon the nature of the knowledge processed in the firm. Our main line of argument is that the current process of increasing knowledge codification may have contributed to the development of new modes of human resource management based on use of the external labour market. In order to carry out our analysis, we deploy a particular theoretical framework, namely that provided by the *competence-based* approach to the firm. This approach seeks to offer an alternative to the standard neo-classical theory of the firm and its most immediate extensions. Since the early 1990s, a very large number of studies have adopted this approach in order to examine, in particular, the sources of firms' competitiveness and the dynamics of technical change. However, little use has been made of this new concept of the firm as defined by its competence base to deal with issues related to human resource management and, more generally, labour economics. However, in our view, it provides a particularly suitable framework for doing this, since the factors driving the changes taking place in the labour market are closely linked to the development of new technologies, which have had a major effect on firms' competence base.

The core of our theory is that the labour flexibility strategy chosen by a firm strongly depends on its competence base. We start from the observation that whenever competences lie to a large extent in individuals, internal flexibility is crucial for firms' performance. On the contrary, when the organisation itself is the main repository of competences, a firm may afford to choose an external flexibility strategy without putting at risk its competence base. Moreover, we argue that this alternative is endogenous to the nature of the knowledge processed in the firm. When knowledge is essentially tacit, keeping core workers through internal labour flexibility proves to be indispensable to the development of competences. On the other hand, if the knowledge is largely codifiable and embodied in the firm itself, then external flexibility may be less costly without being any less efficient, at least in the short run.

This very simple model of the relations between competences, knowledge and labour flexibility leads us to highlight the key role of information and communication technologies (ICTs) in the development of external labour market flexibility. We argue that one possible reason for the decline in internal labour markets is that the spreading of ICTs has shifted the balance away from tacit towards codified knowledge, which has made, in turn, external labour flexibility more profitable.

The competence-based approach to the firm is outlined in the first section of this article. We briefly present the view according to which competences are the basis of firms' performance and highlight the fact that, according to this approach, competences may lie either in individuals or in the organisation itself. In Section 2, we show that firms' decisions in respect of labour flexibility are closely linked to the nature of their knowledge base. This gives rise to two polar labour flexibility configurations depending on how tacit/codifiable knowledge is. In the third section, we adopt a more dynamic perspective and suggest that one reason for the development of external flexibility strategies may lie in increasing knowledge codification due to the diffusion of the new information and communication technologies. By way of conclusion, we examine the long-term sustainability of human resource management strategies based on external flexibility.

1. THE COMPETENCE-BASED APPROACH TO THE FIRM

The competence-based approach to the firm emerged during the 1990s[1] with the aim of shedding light on firms' internal workings. For a long time, indeed, economic theory had regarded the firm as a 'black box', the substance of which could at best be reduced to a

contractual nexus (agency theory) or to a less costly form of coordination than the others (transaction cost theory). However, it would seem impossible to explain, on this basis alone, a number of established empirical facts in industrial economics. In particular, persistent differences in performance between firms within the same sector remain unexplained if firms' internal workings are not taken into account. As recent econometric studies have shown[2], the explanation of microeconomic performance lies not only in a firm's environment or market power but within the firm itself, in the way in which it coordinates inputs and organises them to produce products or service outputs.

1.1 Competences as the basis of firms' performance

The idea that firm's competences play a key role in determining economic performance goes back to the resource-based theory of the firm. As summarised by Conner (1991), the capacity of a firm to generate above-normal returns depends on its ability in acquiring, combining and redeploying resources. In order to do so, the firm's competences are crucial. They encompass its knowledge, but also its ways of doing things as well as its ability to react and adapt. So, the competence base of a firm includes its knowledge base and is specific to the firm. One consequence of this approach is that firms are, obviously, heterogeneous. Since their competences are specific, each firm is different from its competitors. It is hardly surprising, therefore, that microeconomic performance varies, even within sectors. The burden of proof is thus reversed: what would be exceptional would be a situation in which the capacities for innovation and/or productivity of firms that are quite different from each other were in fact identical.

According to the evolutionary theories of firm behaviour, competences are contained within a firm's *routines*. Nelson and Winter (1982) suggest that there is an excess of information in the world, in the sense that it far exceeds agents' abilities to absorb and use it. In particular, firms are not able to maximise on the entire set of alternatives available to them in theory. Consequently, they adopt rules of thumb, which are called routines. Routines differ from firm to firm and incorporate the knowledge accumulated within the organisation. According to Nelson (1991), a firm is defined by a hierarchy of routines that have been put into practice and determine its *organisational competences*. Chandler (1992) specifies their content. They comprise basic organisational knowledge, the coordination of that knowledge, and decision-making procedures that make it possible to decide what has to be done at each level of the firm. At any one time, this

hierarchy of routines defines all the strategies the firm is capable of adopting and all the actions it is capable of taking.

Organisational competences are, furthermore, essentially *dynamic*. According to Teece et al. (1997), one of their characteristics is that they cannot be bought in the market. They must be constructed within the firm in the course of a learning process, whose principal characteristic is that it is cumulative. As Cohen and Levinthal (1990) note, the acquisition of new knowledge takes place essentially on the basis of knowledge already present in a firm. This gives rise to a strong path-dependency phenomenon. As underlined by Teece et al. (1997), previously accumulated competences and the repertoire of existing routines constrain both the management and the content of the learning process: the accumulation of new competences takes place essentially in close proximity to the existing "core of competences". Thus the cumulative and localised nature of the learning process reinforces the specificity of a firm's competences.

More generally, approaches to the firm based on dynamic organisational competences emphasise that such competences determine a firm's productive performance. Prahalad and Hamel (1990) show that a firm's "core competences" shape its decisions in two ways. Firstly, they limit the range of conceivable options (because of path-dependency) and, secondly, they enable a firm to put in place a growth strategy that makes best use of its own resources. So, they play a key role in constructing a firm's competitiveness and, ultimately, determine its market share.

Thus the competence-based approach opens up the ‘black box’ of the firm by highlighting the key role these competences play in defining a firm’s nature and identifying the sources of its competitiveness. To the extent that competences are specific to the firm, this approach emphasises the role of specific (rather than general) knowledge in the building up of firm's comparative advantages. Moreover, it raises the question of the creation and extension of a firm’s competence base and leads us to investigate the forms of human resource management likely to sustain the key process of competence accumulation. This aspect has rarely been tackled in the literature on dynamic organisational competences, since it requires a second black box to be opened up, namely the role of individual employees in the construction of competence. However, it seems particularly important to advance in this direction, since evaluation of the participation of individuals in constructing a firm’s competence base will allow us to characterise some sustainable forms of human resource management.

1.2 The construction of competences

A firm’s competence base can, in principle, be constructed at very different levels. It may be constructed by individuals or, on the contrary, by the group, that is the organisation as a whole. This distinction will bear important consequences when coming to firms' choice with regard to their labour flexibility strategy. Given that the firm's knowledge lies at the core of its competence base, in analysing the construction of competences, we will first adopt a static approach and examine what constitutes a firm's knowledge and competence base. We will see that knowledge and competences may be embodied either in individuals or in the firm itself. Secondly, and more dynamically, we will focus on the *accumulation* of knowledge and competences. Here again, the learning may take place at the level of individual employees or at the level of the group (i.e. the firm) itself.

The firm's knowledge and competence base

The knowledge available to a firm may be embodied in individual workers or, on the contrary, in the organisation as a whole. In the traditional human capital literature (Becker, 1975), knowledge is originally embodied in individuals. Workers accumulate human capital on an individual basis and it is then exploited during their participation in the production process. From this point of view, therefore, knowledge is embodied in individuals, even though those individuals do not necessarily own it. In the case of general human capital, an individual worker possesses her knowledge, which "moves" with her. In the case of specific human capital, the individual worker does not own her knowledge. She is the temporary repository for it, and remains so for as long as she stays with the firm in which she was trained; when she leaves the firm, the value of her knowledge falls to zero. However, in the approach developed by Becker, knowledge of whatever type is always embodied in the individual, whether that individual is merely the temporary repository for it or its real owner.

In the literature based on the notion of competences, on the other hand, it is argued that the knowledge available to a firm is largely embodied in the organisation, that is the firm itself. The basic idea is that the organisation in general, and the firm in particular, is an entity worth more in terms of competences than the sum of its parts. This view of the firm was first advanced by Penrose (1959). The firm is seen as an organisation working as a team whose productive efficiency (hence value) is greater than that of the sum of its parts. Carlsson and Eliasson (1994)

also identify four types of competences all located at the level of the firm: the firm's capacity to make choices and to formulate strategies, its ability to coordinate its activity in order to create competitive advantages, technical competence, and firm's learning capacities which lead to the creation of new competences. In this approach, the whole set of competences is directly constructed at the level of the firm and it is acknowledged that the firm is greater than the sum of its parts.

Individual versus collective learning

In an approach based on dynamic organisational competences, competences are retained to be accumulated through a learning process. Here again, one may wonder whether this learning is primarily individual or collective.

Some authors emphasise the central role played by individuals in the learning process. Eliasson (1990) suggests that the firm should be seen as a "competent team", albeit one that is itself made up of workers who play a crucial role in the learning process. Similarly, for Nonaka (1994), the driving force in the process of competence accumulation is the *individual*. Individuals accumulate knowledge through experience. The quality of that knowledge depends on the variety and quality of the experience and on the extent to which individuals are involved in the learning process. Thus the process of accumulating organisational competences begins with augmenting and enriching the knowledge held by the individuals who make up the organisation. This knowledge is then articulated and amplified by social interaction, but it originates with individuals who learn and who have to be coordinated.

In contrast, for other authors, learning is primarily collective, since it is the organisation itself that learns. This is the view held by Teece and Pisano (1994), who note that learning involves both organisational and individual capacities but emphasise the fact that the learning process is in essence social and collective. This view is shared by sections of the evolutionary school. This school defines the firm in terms of its core competences, that is those that lie at the heart of its knowledge and expertise (Prahalad and Hamel, 1990), and emphasises the fact that these competences are accumulated through the articulation of organisational routines, which are themselves characteristic of the firm. Consequently, it is the organisation itself, much more than its individual members, that does the learning. This characteristic is the very source of the notion of dynamic organisational competences. Teece et al. (1997) observe that a firm's competitive advantage lies in its managerial and organisational processes, which are shaped by its specific

assets and by the evolutionary pathways those assets open up. Thus the creation and reproduction of core competences takes place at the level of the organisation, through a process of *organisational learning*.

Faced with these two concepts of learning, some of the proponents of the competence-based approach have argued in favour of a more integrated analysis. Eliasson (1994) puts forward the notion that economic value is the result of a "merger" of individuals and firms made possible by organisational processes. Firms organise individuals into competent teams, thereby adding organisational knowledge to individual knowledge. Dosi and Marengo (1994) take the argument a step further, advancing the idea that a firm's competences and those of the individuals that make it up co-evolve through a process of mutual adaptation. Ancori et al. (2000) share a similar view. They underline the key impact of individuals' learning abilities upon the way in which knowledge is accumulated and conclude that any approach to knowledge is bound to be highly individual. However, they also emphasise that individual learning processes are embedded into collective ones. In their view, knowledge results from a social construction process first because individual knowledge is limited in scope and has to be socially mobilised in order for learning to take place and second, because, in the course of the learning process, individuals start from knowledge which is held collectively in their community.

Thus competence, like learning, seems to have two dimensions, one individual, the other collective. Our view is that this dual nature of competence proves important when it comes to selecting a labour flexibility strategy. Whether competences lie more in individuals or in the organisation will determine the sustainability of internal versus external labour flexibility. Moreover, this dual nature of competence is not exogenous. It strongly depends upon the type of knowledge processed in the firm. We show that whether knowledge is more or less tacit or codified ultimately makes internal or external labour flexibility more profitable for firms.

2. TYPES OF KNOWLEDGE AND FIRMS' LABOUR FLEXIBILITY STRATEGY

The literature on labour market institutions traditionally identifies two polar forms of flexibility. When it adopts internal flexibility, a firm meets its labour needs by promoting workers it already employs. Adoption of an external labour flexibility strategy, on the other hand, causes firms to look to the external labour market rather than promotion in order to satisfy their labour demands. In what follows, we will show that in a competence-based approach to the firm, the

viability of these two forms of flexibility depends essentially on the way in which competences are constructed.

2.1 Labour flexibility and the basis of a firm's competence

The choice between internal and external labour flexibility

Faced with continual changes in their environment and, in particular, the emergence of new technological opportunities, firms are obliged to adjust all the factors of production they use. As far as labour is concerned, the necessary adjustments relate not only to quantity but also, and perhaps more importantly, to quality. For example, as a number of recent econometric studies have shown, the introduction and development of information and communication technologies over the past 20 years in the developed economies have considerably increased the demand for skilled labour: technological change has proved to be, on average, skill-biased - see Chenells and Van Reenen (2002) for a review of the literature. So, firms have to decide between (i) a strategy based on external flexibility, in which lower skilled workers are dismissed and replaced by workers with better training in the new technologies, and often with better formal qualifications, and (ii) a strategy based on internal flexibility, in which workers already in post are trained to meet the demands of new production methods. In the first case, the turnover rate will be high, while in the case of internal flexibility it will be low.

Deciding between the two options is not a trivial matter, since the training costs associated with internal flexibility may be higher than the recruitment and dismissal costs associated with external flexibility. This is because training not only gives rise to considerable direct costs, but is also associated with high opportunity costs, since workers undergoing training are not directly productive. It may also take time, particularly when employees have a low educational level. So, it is often accepted that external labour flexibility enables firms to make better *static* adjustments to changes in their environment: in the short term, firms' needs are often better and more quickly met by recourse to the external labour market. On the other hand, what do the medium and long-term prospects look like when the more dynamic effects linked to the accumulation of competences are taken into account? We suggest that this depends essentially on the firm's competence base.

Individual versus collective competences and forms of labour flexibility

When competences are embodied primarily in individuals, the use of external labour flexibility may well not be conducive to the accumulation of a strong knowledge base within a firm. This is particularly the case if the knowledge base of the firm is, to a large extent, specific. There are basically two reasons for this: one is "technological" in nature and is linked to the very characteristics of the learning process, while the other is more strictly economic in nature, linked as it is to incentives.

As far as the technology of learning is concerned, if the employment relationship is too short, employees do not have sufficient time to accumulate the specific knowledge that constitutes much of the basis of competence. This knowledge is accumulated essentially through learning "on the job". So, newly hired employees do not possess all the knowledge required for the firm to function smoothly. Moreover, if the employment relationship lasts for too short a time, they will be replaced before having had the time to acquire that knowledge. If one accepts that the knowledge held by the individuals working in a firm interacts with that of the organisation in order to produce an accumulation of competences, a firm with a high labour turnover will have only a low stock of such competences. Furthermore, it will be poorly placed to accumulate new competences unless it radically alters its management of human resources. The second reason why external labour flexibility may adversely affect the accumulation of dynamic competences is linked to incentive issues. Indeed, the intensity of the effort employees put into accumulating knowledge is essential to the construction of a firm’s competence base. If the firm adopts an external labour flexibility strategy, resulting in shorter employment relationships, employees will not only not have the time but they will also not have the *desire* to accumulate competences. This is due to the fact that competences are to a large extent specific and therefore have a very low value outside the firm. In this situation, employees having to deal with job instability have little incentive to accumulate such competences. The return on their effort may indeed fall to zero if they lose their job.

Of course, whenever knowledge is mostly general, rather than specific, the situation is quite different. In this case, the accumulation of a wide knowledge base is not contradictory with employees moving across firms, even when knowledge is embodied in individuals. This is the case, for example, of highly qualified scientists and engineers employed in R&D occupations in the United Kingdom (see Mason and Wagner, 1999, and Mason et al, 2004). They frequently

change firm and, thus doing, bring in different kinds of individual knowledge acquired through previous experience in other companies, which decisively contribute to firms' innovativeness. However, in most occupations where the knowledge processed is largely specific, external labour flexibility is likely to be detrimental to the accumulation of dynamic competences when they are embodied essentially in individuals. In this case, only the long careers[3] permitted by internal flexibility are likely to foster the development of a competence base which will sustain the firm's competitiveness. They are necessary for the dynamics of competence construction to become established in a context in which individuals play a key role.

In contrast, this may not be the case even for specific knowledge when the basis of a firm's competence is essentially collective and embodied in the organisation. When a firm's competence is largely contained within its structures and routines, it is much less dependent on each of its employees taken individually than in the previous case. Much of the learning takes place independently of the workers' conscious participation, through the dynamic articulation of organisational routines. So, a firm is much more than the sum of its parts, and some authors go so far as to state that workers can be replaced at no cost. According to Teece and Pisano (1994), as long as its structures and internal procedures remain in place, the firm's performance cannot really be damaged. A change in its environment constitutes a much more serious threat than the loss of one or more employees. As Chandler (1962) puts it: "individuals come and go, the organisation remains".

In such a situation, human resource management based on internal flexibility would seem to be ill-suited to the firm's needs. Internal flexibility gives rise to training costs and is less effective than recourse to the external labour market in effecting a static adjustment to changes in the environment and in the firm's demand for skilled labour. Under these circumstances, and since high labour turnover is not likely to hamper the accumulation of competences that are mainly embodied in the organisation itself, a strategy based on external labour flexibility appears to be more efficient. It permits to reduce costs in the short term without putting at risk the sources of the firm's long-term competitiveness.

So, the sustainability of internal versus external flexibility strategies in the management of human resources largely depends on the nature of a firm's competence base. We argue that the latter is closely linked to the more or less tacit nature of knowledge used and produced within the firm.

2.2 Tacit knowledge, codifiable knowledge and forms of labour flexibility

At this stage of the analysis, one might wonder whether certain forms of competences have, by their very nature, a more individual basis than others. In other words, are some competences embodied mainly in individuals while others would be embodied mainly in the firm? Our view is that the more the knowledge forming the basis of the competence is *tacit*, the more it tends to be embodied in individuals. Conversely, a competence cannot be embodied in the organisation itself, independently from the individuals, unless the underlying knowledge is largely codifiable in nature.

How iconoclastic is this view?

At first sight, our proposition appears to be antagonistic to the view usually held by scholars in the field of knowledge. Spender (1996) depicts four types of organisational knowledge using a 2x2 matrix in which the individual/social dimension of knowledge is interacted with its tacit/explicit nature. In his analysis, all combinations between the four types of knowledge are equally possible. Ancori et al. (2000) share the same view and argue that all typologies of knowledge can be presented using Spender's matrix. So, the general idea about knowledge is that both tacit and explicit knowledge can be equally embodied in individuals and in organisations.

We argue here is that this is not exactly the case. Our view is that tacit and codified knowledge can certainly be held both by individuals and by the organisation. However, be it mobilised at the social or individual level, tacit knowledge ultimately lies in individual workers in the sense that it cannot be operated in their absence. As a consequence, knowledge cannot lie at the level of the organisation itself, independently from individuals, if not largely codifiable. However, this does not prevent individuals from holding codified knowledge, nor tacit knowledge from showing up at the collective level. Our bottom line argument is that, in the case of tacit knowledge, the knowledge operating unit is the individual, whereas in the case of codified competence, it can be the organisation.

Tacit knowledge and a competence based on individuals

The notion of tacit knowledge was introduced by Polanyi (1966) and was illustrated by his now famous dictum: "we know more than we can say that we know". Polanyi’s argument is

that a large part of the knowledge individuals possess is difficult to articulate in the sense that the agent himself is often unable to explain the procedures underlying the manifestation of the knowledge. Tacit knowledge is intuitive, not articulated and difficult to codify or transfer.

Lam (2000) uses the term "subjective" to denote such knowledge, thereby highlighting its largely individual aspect. In her view, such knowledge is personal and contextual and requires close collaboration with the "knowing subject" if it is to be put to use. Thus the tacit form of knowledge appears to be deeply rooted in individuals. Cohendet et al. (1999) point out that tacit competences can be acquired only through experience (learning by doing) and therefore have a strong individual dimension. Similarly, according to Eliasson (1990), tacit knowledge is embodied in individual agents or teams, although in both cases the competence has its basis in the individual.

This leads us to suggest that the more tacit knowledge is, the more it tends to be embodied in individuals. Working together in an organisation may make it possible to create a knowledge base greater than the sum of its individual parts, but the competence still has its actual basis in the individual, since without him the competence does not exist.

From here, we identify a first polar configuration such that, when the competence at work in the production process is essentially tacit, its basis is individual and an internal labour flexibility strategy appears to be the only viable option open to the firm. In this situation, any attempt to look outside the firm for sources of labour flexibility would impede the accumulation of dynamic organisational competences, which would limit any expansion of the firm’s tacit knowledge base. Carlsson and Eliasson (1994) note that, when tacit competences exist, effecting labour adjustments by re-allocating talents within the firm is more likely to foster the accumulation of dynamic competences than recruiting personnel in the external market. Cowan et al. (2000) say nothing different when stressing that the "attrition of key personnel" may be detrimental to the accumulation of tacit knowledge. Thus tacit knowledge, individually based competences and internal labour flexibility seem to combine to produce a configuration in which, when knowledge is essentially tacit and its basis is largely individual, only an internal labour flexibility strategy is likely to enable a firm to reach its maximum productive potential. A second polar configuration, the diametric opposite of the first one, may arise when the knowledge deployed in the production process is largely codifiable.

Codifiable knowledge and collectively based competences

Knowledge is defined as explicit when it can be easily codified and hence communicated in a formal and systematic language (Foray, 2003). Such knowledge may be produced by logical deduction and acquired through study without lengthy practical experience being necessary. It is generally contained in media such as written documents, computer programs or patents. Consequently, it is easily specified and communicated verbally or in writing. This knowledge is often described as codifiable; its principal characteristic is that it may be passed on without the active participation of the "knowing subject" (Lam, 2000).

So, codified knowledge is not directly embodied in individuals. It is, rather, contained in documents, software or even in procedures and routines that are not directly linked to an individual. The idea we are advancing here is that a set of competences cannot have a collective basis, independent from the individuals, unless the knowledge underlying the competences is largely codifiable[4]. The reason for this is that, if a competence is to be held and accumulated at the level of the organisation rather than by the individuals of whom that organisation is made up, the competence in question must be readily transferable. If not, the knowledge operating unit remains the individual and knowledge is then embodied in each individual worker. In this case, the basis of the competence is no longer the organisation but the individual. Thus in order for organisational competences to be held by a collective entity independently from its members, the knowledge underlying those competences must be largely codifiable.

This leads us to identify a second polar configuration, in which a largely codifiable competence is held by the firm itself which allows it to opt for an external labour flexibility strategy. In order for this to be the case, the competence has to be constructed at the level of the organisation, which enables the firm to adopt an external flexibility strategy without putting its long-term productivity at risk. In turn, external mobility among employees encourages the firm to invest in the codification of its knowledge in order to protect itself from the danger to which the risk of their workers leaving would otherwise expose them. Codification then appears as a potential response to external flexibility, which is itself made possible by the existence of collectively held knowledge. This compatibility between codifiable knowledge and recourse to the external labour market is also emphasised by Lam (1997). She highlights the fact that, when workers are likely to leave a firm, it is in the firm’s interests to "separate knowledge from

individuals" in order to store it in written procedures. In other words, it is in its interest to invest in codification.

We have therefore identified two distinct polar configurations. The first one is characterised by the existence of individually based tacit knowledge that is consistent with an internal flexibility strategy. In contrast, the second one is characterised by codifiable knowledge rooted in the organisation itself and is consistent with human resource management based on external labour flexibility. With this model in mind, it is possible to analyse the recent changes in labour flexibility strategies. One important factor in deciding where a firm will stand on the axis joining the two polar configurations will be, of course, the extent to which its knowledge base can be codified. So, the reduction in the cost of codification brought about by the introduction of new information and communication technologies may explain at least part of the recent erosion of the forms of human resource management based on internal labour flexibility.

3. ICTs, KNOWLEDGE CODIFICATION AND THE DEVELOPMENT OF EXTERNAL LABOUR FLEXIBILITY

Over the last twenty years, the use of external labour flexibility strategies has increased considerably in most industrialised countries at the expense of internal labour markets. The reasons for this transformation have been little investigated to date. Gautié (2004) spotlights the key role played by the shortening of firms' time horizons due to rises in real interest rates that took place in the 1980s, increasing competitive pressure and important restructurings that occurred over the period. A few empirical works also emphasise the impact of information and communication technologies (ICTs). Di Prete et al (2002) find that returns to tenure are lower than average in high-tech industries in the USA, suggesting that the "freshness" of workers has become more valuable than their experience in innovative firms. Similarly, Givord and Maurin (2004) find that the use of new technologies increases the annual transition rate from employment to unemployment, and that this is enough to explain the global trend toward greater job insecurity observed in France. These results suggest that firms meet the new skill requirements following the introduction of information technologies through adjustments on the external rather than internal labour market. We suggest that this may have to do with the impact of ICTs upon knowledge codification and the creative destruction of competences.

3.1 ICTs and the development of knowledge codification

Many authors highlight the fact that a given body of knowledge is never completely tacit or completely explicit. Ancori et al. (2000) point out that the interpretation and use of a body of codified knowledge always requires the deployment of tacit competences, which suggests that the two forms of knowledge are closely interrelated. This is particularly the case when a system is complex so that the management of numerous codified procedures may require some tacit meta-competences. Ancori et al. (2000) also insist that the process of codification itself requires some tacit capabilities. From a more dynamic point of view, Nonaka (1994) suggests that the "externalisation" of knowledge, that is the shift from the tacit to the explicit form, is the very basis of competence dynamics.

Despite the existence of these links between the two forms of knowledge, it seems that the introduction of ICTs has shifted the balance between tacit and codified knowledge. According to Foray and Lundvall (1996), even though codification is never perfect, the boundary between the two forms of knowledge has recently shifted in favour of codified knowledge. One exception to this trend can be found in R&D occupations where individual knowledge has remained crucial, in particular because experienced researchers possess personal networks that may be of great help to get technical and/or market information and advice (see Mason et al., 2004). However, in occupations closer to the production process, knowledge codification seems to have increased following the diffusion of ICTs. This view is supported by Cohendet et al. (1999), who highlight the development of written rules and the adoption of new modes of communication that help to objectify exchanges between individuals. One reason for this is that ICTs reduce the cost of codification. According to Cowan and Foray (1997), new technologies increase capacities for the storage, processing and transmitting of information. This is due in part to the development on a large scale of fibre optic networks. Such networks increase the quantity of information that the physical infrastructure is able to carry, which in turn reduces the cost of transmitting digital data. This being so, increasingly complex sequences of data are likely to be codified without significantly higher costs being incurred. On the other hand, according to Cowan (2001), ICTs raise the benefits of codification. For example, expert systems require some knowledge codification to work smoothly. So, due to lower costs and greater benefits, firms increasingly invest in the codification of their knowledge base - Cowan and Foray (1997).

As a result, firms' knowledge bases tend to become more collective, in the sense we outlined in section 2. As the knowledge mobilised in the production process becomes less and less tacit, the basis of a firm's competence becomes less individual. Increasingly, this competence can be embodied in firms themselves, to the detriment of the individuals who constitute it. In these circumstances, use of the external labour market becomes less expensive for firms than maintaining an internal flexibility strategy, and an increasing number of them can be expected to change their modes of human resource management.

The development of new information and communication technologies is thus likely to have contributed significantly to the increased use of external forms of labour flexibility due to the (negative) impact of knowledge codification upon their relative cost. The extent to which external flexibility has spread at the expense of internal labour markets varies, of course, across firms. Among others, it depends on the extent to which knowledge can be codified. In particular, Cowan (2001) stresses that the cost of codification varies greatly according to the type of knowledge: linear, direct processes are quite easy to codify, whereas pattern recognition is much more costly. Moreover, part of the knowledge processed and created in a firm may not be articulable which makes it non codifiable. Overall, the degree of codifiability of knowledge varies a great deal across firms, thus affecting their incentives to introduce external labour flexibility. So, our model predicts that the development of ICTs contributes to destabilise forms of human resource management based on internal labour flexibility. But it also implies that a variety of labour strategies will persist depending upon the local cost of knowledge codification.

So, the first linkage between ICTs and the development of external labour flexibility lies in their positive impact upon knowledge codification. As stressed above, this is specific to the current wave of technological innovation which has reduced the cost of the storage and transmission of information. A second linkage between ICTs and the destabilisation of internal labour flexibility has to do with their impact on firms' competence base and is not specific to ICTs.

3.2 ICTs and the creative destruction of competences.

Like most radical innovations, ICTs have a *creative destruction* impact on firms' competence base: they reduce the value of the competences accumulated in the old technological paradigm and create an incentive to replace part - if not all - of these competences.

One reason why the productive value of a firm's competence base may decrease when adopting ICTs is that these introduce a *radical* innovation. As such, they deeply modify the production methods and work organisation within firms. In such circumstances, competences accumulated on the previous technology and/or specific to the old way of organising work become partly useless: there is competence obsolescence. So, the relationship between existing knowledge and the firm's performance weakens and, in order for competitiveness to be maintained, competences have to be adapted. This is the first aspect of creative destruction.

However, required changes in a firm's competence base may be more drastic if it becomes an obstacle to the adoption of the radically new technologies. This may happen when the various competences are strongly complementary one with the other. As shown by Milgrom and Roberts (1992), it is then difficult, if not impossible, to marginally change the competence base and the only way to adapt existing knowledge to the new technological paradigm is to renew the entire set of competences. This is of course extremely costly and some firms may thus be reluctant to adopt new technologies. In such circumstances, according to Teece (1993), core-competences turn into "core-rigidities" and the competence base of the firm becomes an obstacle to radical innovation. In this case, a firm may delay adoption of ICTs, but when it eventually decides to do it, this induces a drastic form of creative destruction since its whole competence base has to be renewed.

There is a debate as to whether creative destruction of competences is just a one shot event due to ICTs bringing about a radical change in the production process or whether it is an ongoing phenomenon due to the very characteristics of ICTs. In both cases though, it will impact the firm's human resource management strategy and, more specifically, contribute to the destabilisation of internal labour flexibility. The reason for this is that, as soon as accumulated competences become a handicap rather than a source of competitive advantage, any mode of management based on internal labour flexibility has no longer any comparative advantage. Such a strategy makes sense only as long as it enables a firm to improve its productive capacities by extending its tacit knowledge base. As soon as this is no longer the case, internal flexibility becomes more costly than recourse to external labour markets. This is particularly the case when a firm's competence base has to be largely renewed, since renewal of the labour force itself may appear as a simple and efficient way of fostering changes. So, when ICTs bring about a drastic form of creative destruction of competences, they are likely to raise the benefits of external labour flexibility as compared to internal promotion.

To sum up, when ICTs are introduced, human resource management strategies based on external labour flexibility may, at some point, become more profitable for firms. Not only are they less costly in the short term, but they also allow firms to renew their knowledge base and bring it up to the standards of the new technological paradigm. In the short and medium run, it is likely to reinforce the effects of knowledge codification, thus creating an incentive for an increasing number of firms to shift to forms of human resource management mostly based on external flexibility.

CONCLUSION

In this article, we provide an analytical framework to account for the current destabilisation of internal labour markets and the development of human resource management strategies based on external flexibility. We underline the potential role of ICTs in this evolution, through their long term impact on knowledge codification and short term effect on the creative destruction of competences.

The question raised by this analysis is: how viable are external labour flexibility strategies in the long run? We have argued, in section 2, that the more widespread external labour flexibility tends to become, the more it will be in firms' interest to invest in the codification of their knowledge base. However, Cowan et al. (2000) point out that the codification of a firm's knowledge base to a very advanced level can itself be a source of rigidities. In their view, the accumulation of successive generations of codes may impede the development of radically new forms of knowledge. Codification encourages communication and makes exchanges more efficient; however, it is also a source of "organisational rigidity" and produces uniformity. As soon as the members of an organisation start to specialise in a certain type of information capable of being transmitted in codified form, they become gradually less proficient at exchanging non-codified knowledge. In the long term, this development may prove damaging to firms' innovative capacities, since it tends to encourage reproduction rather than inventiveness.

More generally, the job instability that goes hand in hand with the use of external flexibility does not favour the development of a firm's tacit competence base. In the short term, this strategy may prove profitable, particularly at a time of increased codification of knowledge and/or radical innovation. However, if firms go through phases in which the technological opportunities open to them are radically new and then through phases of more marginal

improvements, the switch towards a form of human resource management based on external flexibility may turn out to be dangerous in the long term. This may, in particular, be the case, when most firms will have adapted to ICTs so that western economies will move to a phase of slower and more incremental technological evolution. In such circumstances, the importance of individual tacit knowledge may increase again, thus leading firms to try and come back to more internal forms of labour flexibility. Whether this will be feasible or not will depend on how reversible changes in human resource management strategies are.

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[1] Nevertheless, the very earliest studies in this area go back to Penrose (1959).
[2] See the vast empirical literature produced in the 1990s on the impact of technological innovation and new forms of work organisation on firms' productivity. Bresnahan et al. (2002) provide one example of this approach.
[3] Johnson et al. (2002) also argue in favour of a relation between tacit knowledge and long-term contracts with employees.
[4] To put it in a sharper way, codification contributes to the "alienation" of knowledge. The more codified knowledge is, the easier it is for the organisation to expropriate individuals from their knowledge.